

**NISTIR 8280**

**Ongoing Face Recognition  
Vendor Test (FRVT)  
Part 3: Demographic Effects**

**Annex 1 : Description and examples of images and  
metadata: Mugshots**

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(a) Mugshot

Figure 1: The figure gives simulated examples of the law enforcement mugshot photographs used in this report.

## 1 Law enforcement mugshot photos

This annex documents the mugshot images used in this report

The main mugshot dataset used is referred to as the FRVT 2018 set. This set was collected over the period 2002 to 2017 in routine United States law enforcement booking procedures. This set has been extracted from a larger operational parent set by excluding non-face images, and setting aside webcam and profile-view images, for use in separate tests.

[NIST Interagency Report 8271](#) and its precursor [NIST Interagency Report 8238](#) include extensive tabulation of performance available with these images.

- ▷ **Demographic composition:** The photos are accompanied by text metadata labels for sex and race. The labels conform lexicons established by the Electronic Biometric Transmission Specification (EBTS)<sup>1</sup>.

**Sex:** This information is contained in field 2.024 of EBTS records. The set used here contains 26 986 919 million photos of 12 331 255 persons, with 21.3% labeled as women and 75.5% as men. Of the remainder nearly 3.18% do not have any sex metadata, and about 0.02% have sex labeled as "X", "U", "N", "G", "Y", "Z", "T" and "UNKNOWN". We restricted our analysis to those images with the "M" and "F" labels. It is not clear whether operational practice is for the sex values to be self-reported or assigned by the attending officer.

**Race:** This information is contained in field 2.025 of EBTS records. The standard requires race to be encoded with one of five values as follows, the quoted text being taken from the EBTS standard verbatim:

- ▷▷ **A:** is used for "Chinese, Japanese, Filipino, Korean, Polynesian, Indian, Indonesian, Asian Indian, Samoan, or any other Pacific Islander";
- ▷▷ **B:** is used for "person having origins in any of the black racial groups of Africa";
- ▷▷ **I:** is used for "American Indian, Eskimo, Alaskan native, or a person having origins in any of the 48 contiguous states of the United States or Alaska who maintains cultural identification through tribal affiliation or community recognition";
- ▷▷ **U:** is used for those "of indeterminable race";
- ▷▷ **W:** is used for "Caucasian, Mexican, Puerto Rican, Cuban, Central or South American, or other Spanish culture or origin, Regardless of race".

<sup>1</sup>This standard is published by the Criminal Justice Information Services (CJIS) Division of the Federal Bureau of Investigation in the United States Department of Justice. It defines data records for transactions that (law enforcement) agencies can make with the FBI. Version 10.0.7 of the standard was published on December 5, 2016. See <https://www.fbi Biospecs.cjis.gov>.

Sex	Race				Unknown
	Asian	Black	Indian	White	
Female	0.4%	7.4	0.2	16.5%	0.3%
Male	1.2%	19.9	0.4	48.4%	1.4%
Unknown	0.0%	0.0	0.0	0.0%	3.9%

Table 1: Proportion of subjects in the law enforcement mugshots by sex and race category.

Sex	Race			
	Asian	Black	Indian	White
Female	1.42	1.99	2.29	1.85
Male	1.64	2.93	2.76	2.10

Table 2: subject stats

The proportions of photos so labelled are 60.2% labelled "W" (White), 33.3% "B" (Black), 1.1% "A" (Asian), and 0.7% "I" (Indian). Of the remainder, 3.2% have no assigned label, 1.4% have "U" (Unknown), and about 0.1% have race labeled with 17 other (undocumented) labels.

Those numbers are proportions of images. The proportions of subjects in the dataset because there are a variable number of images per person. Table 1 summarizes this.

The mean number of photos per person, by demographic by group is as follows.

We retain only the 11 569 390 subjects whose sex is labeled as "M" or "F", and whose race is "A", "M", "F" or "I".

- ▷ **Capture standards:** The images have reasonable compliance with the ANSI/NIST ITL1-2011 Type 10 standard's subject acquisition profiles levels 10-20 for frontal images [?]. The most common departure from the standard's requirements is the presence of mild pose variations around frontal - the images of Figure 2 are typical.
- ▷ **Encoding:** The images are encoded as ISO/IEC 10918 i.e. JPEG.
- ▷ **Compression:** The images vary in size, with many being 480x600 pixels and compressed filesizes of between 18 and 36KB with many images outside this range, implying that about 0.5 bits are being encoded per pixel.
- ▷ **Example images:** Example images are shown in Figures 2 These are drawn from NIST Special Database 32 which may be downloaded [here](#).

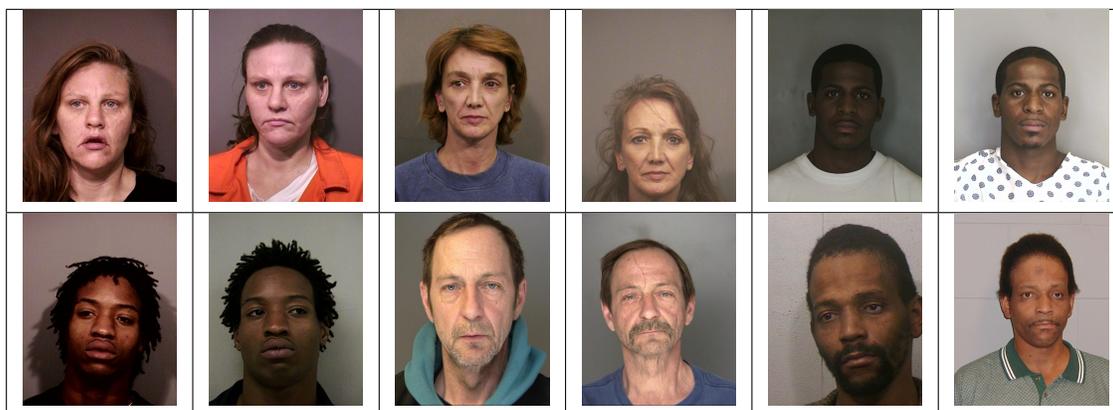


Figure 2: Six mated mugshot pairs representative of the FRVT-2014 (LEO) and FRVT-2018 datasets. The images are collected live, i.e. not scanned from paper. Image source: NIST Special Database 32



Figure 3: Twelve webcam images representative of probes against the FRVT-2018 mugshot gallery. The first eight images are four mated pairs. Such images present challenges to recognition including pose, non-uniform illumination, low contrast, compression, cropping, and low spatial sampling rate. Image source: NIST Special Database 32

These images were partitioned in galleries and probesets for the various experiment listed in Table 3.

	ENROLLMENT				SEARCH			
	TYPE SEE	POPULATION	N-SUBJECTS	N-IMAGES	MATE		NON-MATE	
	SECTION ??	FILTER			N-SUBJECTS	N-IMAGES	N-SUBJECTS	N-IMAGES
<b>Mugshot trials from enrollment of single images</b>								
1	RECENT	NATURAL	640 000	640 000	154 549	154 549	331 254	331 254
2	RECENT	NATURAL	1 600 000	1 600 000				
3	RECENT	NATURAL	3 000 000	3 000 000				
4	RECENT	NATURAL	6 000 000	6 000 000				
5	RECENT	NATURAL	12 000 000	12 000 000				
<b>Mugshot trials from enrollment of lifetime images</b>								
6	CONSOL	NATURAL	640 000	1 247 331				
7	CONSOL	NATURAL	1 600 000	3 351 206				
8	CONSOL	NATURAL	3 000 000	6 417 057				
9	CONSOL	NATURAL	6 000 000	12 976 185				
10	CONSOL	NATURAL	12 000 000	26 107 917				
11	UN-CONSOL	NATURAL	640 000	1 247 331				
12	UN-CONSOL	NATURAL	1 600 000	3 351 206				
<b>Cross-domain</b>								
13	MUGSHOTS AS ON ROW 2				82 106 WEBCAM	82 106 WEBCAM	331 254 WEBCAM	331 254 WEBCAM
<b>Cross-view</b>								
14	MUGSHOTS AS ON ROW 2				100 000 PROFILE	100 000 PROFILE	100 000 PROFILE	100 000 PROFILE
<b>Ageing</b>								
17	OLDEST	NATURAL	3 068 801	3 068 801	2 853 221	10 951 064	0	0

Table 3: **Enrollment and search sets.** Each row summarizes one identification trial. Unless stated otherwise, all entries refer to mugshot images. The term “natural” means that subjects were selected without heed to demographics, i.e. in the distribution native to this dataset. The probe images were collected in a different calendar year to the enrollment image. Missing values in rows 2-12 are the same as in row 1.